

CLAIMS

1. An apparatus for separating and purifying nucleic acids, which comprises:
 - a cylindrical syringe having a leading end part in which a first opening part is formed, a base end part in which a second opening part is formed and an accommodation part between said first opening part and second opening part, the accommodation part being able to hold liquid therein; and
 - a solid phase-holding member connected to said leading end part, a flow hole being formed at the leading end side of the solid phase-holding member;
 - wherein a solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof is accommodated in said solid phase-holding member, the solid phase being able to adsorb and desorb nucleic acids in a sample solution; and
 - wherein a pressure sensor capable of detecting the pressure in the accommodation part is connected.
2. The apparatus for separating and purifying nucleic acids according to claim 1, which comprises a piston member comprising a plunger extending from said second opening part side into said accommodation part and a liquid-tight member provided at the leading end of said plunger, wherein the liquid-tight member can be brought into close contact with the inner surface of said accommodation part and is slidable in said accommodation part.
3. The apparatus for separating and purifying nucleic acids according to claim 2, wherein said piston member is further provided with a check valve that is closed when said piston member is moved to the leading end part side and that is open when said piston member is moved to the base end part side.
4. The apparatus for separating and purifying nucleic acids according to claim 1, wherein said second opening part is connected with a pump that is capable of putting the inside of the accommodation part into a pressurized state.
5. The apparatus for separating and purifying nucleic acids according to claim 1, wherein a circular solid phase-supporting surface is formed on the inner surface of the leading end side of said solid phase-holding member, the solid phase-supporting surface being generally

perpendicular to the longitudinal axis of said syringe; said solid phase that is formed in a circular shape is placed in a direction parallel to said solid phase-supporting surface; the leading end of the leading end part of said syringe that is formed in a circular shape is abutted to the immediate inside of the circular peripheral edge of said solid phase to press the solid phase to the side of said solid phase-supporting surface.

6. The apparatus for separating and purifying nucleic acids according to claim 1, wherein the organic polymer having a hydroxyl group on the surface thereof is a surface saponification product of acetyl cellulose.

7. The apparatus for separating and purifying nucleic acids according to claim 1, wherein the organic polymer having a hydroxyl group on the surface thereof is a surface saponification product of triacetyl cellulose.

8. The apparatus for separating and purifying nucleic acids according to claim 6, wherein the surface saponification rate of acetyl cellulose is 5% or more.

9. The apparatus for separating and purifying nucleic acids according to claim 6, wherein the surface saponification rate of acetyl cellulose is 10% or more.

10. The apparatus for separating and purifying nucleic acids according to claim 6, wherein acetyl cellulose is formed into a porous film or a non-porous film.

11. An apparatus for separating and purifying nucleic acids which comprises a combination of at least two or more apparatuses for separating and purifying nucleic acids according to claim 1, wherein each independent pressure sensor is connected to each apparatus for separating and purifying nucleic acids, and the pressure in the accommodation part of each apparatus for separating and purifying nucleic acids can be independently detected.

12. A method for separating and purifying nucleic acids which comprises adsorbing and desorbing nucleic acids in a sample solution on a solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof by using the apparatus for separating and purifying nucleic acids according to claim 1.

13. The method for separating and purifying nucleic acids according to claim 12, wherein a pressure sensor capable of detecting the pressure in an accommodation part is used to monitor

the pressure in the accommodation part, and the discharge of liquid in the accommodation part is sensed by the pressure change.

14. The method for separating and purifying nucleic acids according to claim 12, wherein the sample solution is a solution which is prepared by adding a water soluble organic solvent to a solution obtained by treating a specimen containing a cell or a virus with a nucleic acid-solubilizing reagent.

15. The method for separating and purifying nucleic acids according to claim 12, wherein the nucleic acid-solubilizing reagent is a guanidine salt, a surfactant and protease.

16. The method for separating and purifying nucleic acids according to claim 12, which comprises the steps of: adsorbing nucleic acids on a solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof; washing the solid phase using a nucleic acid washing buffer; and desorbing the nucleic acids adsorbed on the solid phase using a liquid capable of desorbing the nucleic acids adsorbed on the solid phase.

17. The method for separating and purifying nucleic acids according to claim 16, wherein the nucleic acid washing buffer is a solution containing methanol, ethanol, isopropanol, n-propanol or mixture thereof in a concentration of 20 to 100% by weight.

18. The method for separating and purifying nucleic acids according to claim 16, wherein the liquid capable of desorbing the nucleic acids adsorbed on the solid phase is a solution having a salt concentration of 0.5 M or less.

19. The method for separating and purifying nucleic acids according to claim 12, which comprises the steps of:

(a) preparing a sample solution containing nucleic acids by using a specimen, and charging said sample solution containing nucleic acids from a second opening part into an accommodation part;

(b) pressurizing the inside of said accommodation part of the apparatus for separating and purifying nucleic acids to discharge the charged sample solution containing nucleic acids from a flow hole to bring the solution into contact with the solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof;

(c) charging a nucleic acid washing buffer from said second opening part of the apparatus for separating and purifying nucleic acids;

(d) pressurizing the inside of said accommodation part of the apparatus for separating and purifying nucleic acids to discharge the charged nucleic acid washing buffer from said flow hole to bring the buffer into contact with the solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof;

(e) charging a liquid capable of desorbing nucleic acids adsorbed on the solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof from said second opening part of the apparatus for separating and purifying nucleic acids; and

(f) pressurizing the inside of said accommodation part of the apparatus for separating and purifying nucleic acids to discharge the charged liquid capable of desorbing nucleic acids from said flow hole to desorb the nucleic acids adsorbed on the solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof and discharge the nucleic acids to the outside of the apparatus for separating and purifying nucleic acids.

20. The method for separating and purifying nucleic acids according to claim 19, wherein in steps (b), (d) and (f), a pressure sensor capable of detecting the pressure in an accommodation part is used to monitor the pressure in the accommodation part to sense the discharge of liquid in the accommodation part by the pressure change, and next step starts after sensing the discharge of liquid.

21. A method for separating and purifying nucleic acids, which comprises the steps of:

(1) pressurizing a nucleic acid-containing sample solution in a container to pass said sample solution through a solid phase located in the container to adsorb the nucleic acids on the solid phase;

(2) adding a washing solution into the container and pressurizing said washing solution to pass through the solid phase to wash the solid phase; and

(3) adding a liquid for desorbing the nucleic acids from the solid phase into the container and pressurizing said liquid to pass through the solid phase to recover the nucleic acids into said liquid,

wherein the pressurization of the sample solution in step (1) is stopped when the pressure inside the container reaches a certain level.

22. The method for separating and purifying nucleic acids according to claim 21, wherein the pressurization in step (2) and/or step (3) is stopped when the pressure inside the container reaches a certain level.

23. The method for separating and purifying nucleic acids according to claim 21, wherein a certain pressure is set so that no liquid remains in the container.

24. The method for separating and purifying nucleic acids according to claim 21, wherein a pressure sensor is used to detect that the pressure in the container has reached a certain level.

25. The method for separating and purifying nucleic acids according to claim 21, wherein the solid phase is a solid phase comprised of an organic polymer having a hydroxyl group on the surface thereof.

26. The method for separating and purifying nucleic acids according to claim 21, wherein the organic polymer having a hydroxyl group on the surface thereof is a surface saponification product of acetyl cellulose.

27. The method for separating and purifying nucleic acids according to claim 21, wherein the organic polymer having a hydroxyl group on the surface thereof is a surface saponification product of triacetyl cellulose.

28. The method for separating and purifying nucleic acids according to claim 26, wherein the surface saponification rate of acetyl cellulose is 5% or more.

29. The method for separating and purifying nucleic acids according to claim 21, wherein the nucleic acid-containing sample solution is a solution which is prepared by adding a water soluble organic solvent to a solution obtained by treating a specimen containing a cell or a virus with a nucleic acid-solubilizing reagent.

30. The method for separating and purifying nucleic acids according to claim 29, wherein the nucleic acid-solubilizing reagent is a guanidine salt, a surfactant and protease.

31. The method for separating and purifying nucleic acids according to claim 21, wherein the washing solution is a solution containing methanol, ethanol, isopropanol, n-propanol or mixture thereof in a concentration of 20 to 100% by weight.

32. The method for separating and purifying nucleic acids according to claim 21, wherein the liquid capable of desorbing the nucleic acids from the solid phase is a solution having a salt concentration of 0.5 M or less.

33. The method for separating and purifying nucleic acids according to claim 21, wherein adsorption and desorption of nucleic acids are performed using an apparatus for separating and purifying nucleic acids in which a solid phase is accommodated in a container having at least two openings.

34. The method for separating and purifying nucleic acids according to claim 21, wherein adsorption and desorption of nucleic acids are performed using an apparatus for separating and purifying nucleic acids comprising (a) a solid phase, (b) a container having at least two openings for accommodating said solid phase, (c) a pressure difference generating apparatus coupled to one of the openings of said container and (d) a pressure sensor.